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UNITED STATES.

THE PROPHYLAXIS OF PLAGUE BY PREVENTIVE INOCULATIONS—BY DR. A. CALMETTE, DIRECTOR OF THE PASTEUR INSTITUTE AT LILLE.

[Read at the International Congress of Hygiene and Demography, at Paris, August, 1900.—Translated by M. J. Rosenau, Passed Assistant Surgeon, U. S. M. H. S.]

Since the work of Roux, Yersin, Calmette, Borrel, Salimbeni, and Haffkine, the efficacy of the preventive inoculations, whether by antipest serum or by cultures of the bacillus pestis killed by exposure to 70°C. for one hour, can no longer be doubted.

We know that the serum confers an immunity, certain and effective, almost immediately after the injection. This immunity is, however, unfortunately of very short duration; it rarely exceeds twelve to fourteen days. It is therefore necessary, in using the antipest serum as a preventive, to inoculate 10 c. c. of the serum every two weeks in order to insure protection. This method has both its advantages and its disadvantages.

The advantages are:

1. It confers an immunity almost absolute and immediate.
2. The injection of the serum is not painful, and is therefore readily accepted, even by children.
3. It is never harmful.
4. The serum, when it is prepared antiseptically, is a product whose activity remains intact a very long time, almost indefinitely.

The disadvantages are:

1. The very short duration of the immunity.
2. The cost of producing the serum and the difficulty of obtaining it in sufficient quantity in order to vaccinate the population of an entire city every fourteen days.

3. The difficulty of making obligatory or even of inducing a majority of the population to accept a vaccination which must be repeated so frequently.

These disadvantages are of such a nature as to limit, to a great extent, the employment of the serum as a prophylactic. Its use is, however, indicated under the following circumstances:

(*a*) On board of infected vessels during the voyage to prevent the disease spreading among the passengers or crew.

(*b*) In order to immunize the personnel in the lazaretto as well as those concerned with the unloading or disinfection of merchandise brought by suspected vessels or vessels having had cases of plague on board.

(*c*) In the docks, warehouses, and stores where suspected merchandise is sometimes handled.

(*d*) In times of epidemic, for the immediate protection of persons found in contact with the sick and who may be already infected.

* * * * * * *

The method of vaccination by cultures of the bacillus pestis killed by heat at 70° C., applied on a very large scale by Haffkine for the past three years in India, possesses the undoubted advantage of conferring a much longer immunity than that produced by the antipest serum.

The duration, however, of this immunity is very variable. It depends upon the quality of the microbian bodies contained in the culture, the age of the same, its toxicity, and mode of preparation.

It is impossible to fix the duration of this immunity in man. It may be only a few days or several months. Among animals susceptible to plague, as the monkey, the immunity produced by one single injection of 2 to 3 c. c. of Haffkine's vaccine does not exceed, according to my experience, three weeks to a month. It is necessary to repeat the injection two or even three times at intervals of a week in order to obtain in animals an immunity which may last three or four months, rarely longer.

Haffkine did not study experimentally the effects of his vaccination. In order to satisfy myself of its value I undertook the vaccination, by his method, of several series of monkeys, guinea pigs, and rats in order to determine not only the duration of the immunity after one, two, or three injections of the heated culture repeated at weekly intervals, but especially with a view to determine the moment when the immunity appears after the inoculation of the vaccine.

I have been able to satisfy myself that the immunity after one single inoculation of 3 c. c. of a bouillon culture one month old, and heated one hour at 70° C., is not established until after the seventh day. It lasts, on an average, three weeks in a guinea pig, a month in the monkey. The proof of resistance was established in all the animals with an equal dose of the same culture—that is, $\frac{1}{100}$ of a forty-eight-hour culture in a jar. In a rat the immunity lasts longest. After one single injection of 2 c. c. of the heated culture, according to my experience it continues for three months.

We can arrive at no conclusion from these facts as to what may take place in man. Although, since the Haffkine vaccination is more efficacious in the rat, an animal very susceptible to plague, than in the guinea pig, an animal less susceptible, it may be admitted, as Haffkine believes, that one single injection of the vaccine is capable of giving a longer immunity in man than in animals.

We ought to conclude nothing more than that this vaccination of Haffkine's is very useful in infected countries for the following reasons:

1. Large quantities of Haffkine vaccine may be readily prepared, and almost without cost, in a short time, by growing cultures of the bacillus of plague for one month and heating them at 70°C. for one hour.

2. The inoculation of the heated cultures is accepted easily enough; it provokes only a little inflammation and lymphangitis for five or six days about the point of inoculation.

3. We may vaccinate the population of an entire village, or of a country, with the heated cultures and thereby eliminate the susceptibility to the disease, and, in consequence, prevent its spreading.

This method is, however, open to serious objections. In infected countries its application must be obligatory and enforced by the authorities, which is a restriction to its usefulness.

(*a*) I have shown with Mr. Salimbeni, during the recent epidemic in Oporto, that during the period of immunization with the heated cultures the animals are extremely sensitive to minimum doses of the virus of plague, which are rarely lethal for nonvaccinated animals. It therefore follows that a person during the stage of incubation of a mild case of plague could have his disease considerably aggravated if he submitted at this time to the preventive vaccination with Haffkine's virus. It would almost certainly be fatal.

This explains the several cases of rapid death from pest which have been observed in India, at Bombay, and at Damaun, following the Haffkine inoculations.

(*b*) The injection of heated cultures produces more or less fever, ordinarily of short duration, but sometimes sufficiently strong to oblige the subjects to take to their beds.

(*c*) The heated cultures retain their activity a much shorter time than the serum—not more than six months. The combined action of the air and light attenuates very quickly the toxicity of these cultures. They must therefore be frequently renewed and old vaccine must not be used.

Despite these objections it must be admitted that the method of vaccination by heated cultures may render great service in times of epidemic. It makes it possible to limit the disease almost immediately to its focus.

The employment of antipest serum, which does not have the dangers of the Haffkine vaccine, is therefore more advantageous especially for boats, lazarettoes, hospitals, and posts of observation; not only because it constitutes an excellent means of prevention but because, while it is a prophylactic, *it is the only efficacious remedy that may be employed in the treatment of plague after the disease has appeared.*

The plague is now an actual and permanent menace for all the ports of Europe and America which have commercial relations with infected countries. All vessels from an infected port should be provided with a sufficient quantity of antipest serum.

Special instructions should be given to the physician or captain on board of each boat relative to the employment of the serum as a prophylactic for all on board should a suspected case show itself. Similar instructions should be promulgated relative to the measures to be taken for the destruction of rats and other parasites (mosquitoes and fleas) capable of propagating the disease, as well as for conveniently disinfecting merchandise en route if a case of plague should appear on board.

The lazarettoes, the sanitary services, the civil and marine hospitals of all the ports should possess and renew at fixed times a supply of antipest serum. At ports where bacteriological laboratories exist, the director of the laboratory should take charge of the serum, should distribute it to the port physicians and to captains, and should give them all necessary instructions. In case the opportunity should present itself, the directors of the laboratories should direct the employment of the serum themselves.

It is well said, "In time of peace prepare for war," and this applies especially to the war against plague. The sanitary physicians of ships and of ports are the sentinels upon whose vigilance all nations depend for the alarm.

The plague will cease to be a constant cause of disquietude and alarm to the civilized world if each country would arm itself as France has done—that is to say, provide the necessary antipest serum to arrest from the first case a nascent epidemic. Each country should organize in its great maritime centers of population, as advance guards, bacteriological laboratories well equipped and directed by competent men.

PREVENTIVE AND RESTRICTIVE MEASURES IN THE TREATMENT OF PLAGUE IN OPORTO.

[Abstract from the New York Medical Record by P. A. Surg. H. D. Geddings.]

The New York Medical Record of August 18, 1900, reviews the article of Dr. Albert Chalmette in the July North American Review on plague in Oporto, and gives a résumé of the measures which were so successfully taken for the suppression of the plague epidemic in Oporto, Portugal. In this article there are many interesting points, and we first note that much stress is laid upon the prevention of the spread of plague among susceptible animals who may play the rôle of agents in the spread of the disease. Next is noted the value that is laid upon protective inoculations with Yersin antiplague serum. It is claimed that 10 c. c. of the antiplague serum, such as is prepared by the Pasteur Institute in Paris, will protect against plague or confer an immunity for three weeks, and it is suggested that such inoculation be made obligatory.

The other methods taken appear to have been—

1. Isolation and obligatory removal of those stricken with the disease to a special hospital.
2. Compulsory vaccination (with the Yersin serum) of all persons who have been in contact with the sick or who inhabit the same house.
3. The building of temporary huts to lodge for a period of twenty days all persons who have inhabited a house where a case of plague has occurred. (This corresponds identically to the establishment of camps of detention and observation which have proved so beneficial in epidemics of yellow fever, smallpox, etc.)
4. Complete disinfection and aëration and abandoning for a period of twenty days all houses where cases of plague have been observed.
5. The organization of search committees composed of doctors, nurses, litter bearers, and police, which committees shall be arranged by districts and shall visit twice a day all dwelling places in their quarter and satisfy themselves that no case of illness exists in them.

This method is especially valuable if, as happens almost always, the population conceals cases of disease. (Notable instances of this concealment have occurred and been a source of great difficulty in the epidemic of plague at Bombay, and, on a smaller scale, it has characterized the conduct of the Chinese inhabitants of San Francisco, Cal., during the recent outbreak of plague in that city.)